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Occupational Health Screenings of Aeromedical Evacuation and Critical Care Air Transport Team Crew Members



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14. ABSTRACT The U.S. Air Force's (USAF) aeromedical evacuation (AE) team and Critical Care Air Transport Team (CCATT) are vital components of the military's medical evacuation mission, transporting wounded, ill, and injured military members to (and between) medical facilities throughout various parts of the globe. The performance, readiness, and health of such airmen are essential to a wide range of combat and humanitarian-based operations. The goals of the study are to (a) assess self-reported behaviors relevant to sustaining health, medical conditions perceived to be created or made worse by their current assignment, and noted changes in usage of medical, mental health, and alternative health services and prescription/over-the-counter medications; and (b) identify differences in these behaviors and conditions between AE and CCATT members who function in deployed settings to provide critical aeromedical care to military personnel. All AE and CCATT crew members were sent surveys, which were anonymous, voluntary, and self-report. A total of 251 AE and CCATT crew members completed the web-based survey, 168 (66.93%) of which were AE crew members, while 83 (33.07%) were CCATT crew members. The response rate for this study was estimated at 40% for AE and 37% for CCATT. A number of recommendations are provided for line and medical leadership for optimizing health and improving performance for both AE and CCATT members, including, but not limited to, the following: considering ways to decrease occupational stress and increase awareness of social climate issues for sustaining effective team performance, understanding and reducing barriers to behaviors that promote health, as well as embedding mental health providers within the respective units for increasing access to specialty mental health care.					
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1.0 EXECUTIVE SUMMARY

The U.S. Air Force's (USAF) aeromedical evacuation (AE) team and Critical Care Air Transport Team (CCATT) are vital components of the military's medical evacuation mission, transporting wounded, ill, and injured military members to (and between) medical facilities throughout various parts of the globe. The performance, readiness, and health of such airmen are essential to a wide range of combat and humanitarian-based operations. However, little is known about their psychological health. The goals of the study are to (a) assess self-reported behaviors (exercise frequency, alcohol and tobacco use, and changes in such behaviors) relevant to sustaining health, medical conditions perceived to be created or made worse by current assignment, and noted changes in usage of medical, mental health, and alternative health services and prescription/over-the-counter medications; and (b) identify differences in these behaviors and conditions between AE and CCATT members who function in deployed settings to provide critical aeromedical care to injured and ill personnel.

Participation in this study was advocated by USAF Air Mobility Command leadership and group commanders through a mass e-mail to all AE and CCATT crew members. The survey was anonymous, voluntary, and self-report. A total of 251 AE and CCATT crew members completed the web-based survey, 168 (66.93%) of which were AE crew members, while 83 (33.07%) were CCATT crew members. The response rate for this study was estimated at 40% for AE and 37% for CCATT.

Datasets from the web-based occupational health surveys obtained for both AE and CCATT crew members were merged. Group frequencies and proportions were calculated for the following: (a) demographics (gender, age range, and marital status); (b) occupational variables (rank range and time in current duties); (c) health behaviors (frequency of physical exercise per week); (d) poor health habits (amount of alcohol use and elevated alcohol use, i.e., four or more times a week, three or more beverages per occasion) and increases in alcohol and tobacco use; (e) increased healthcare utilization (medical care, mental health support, and alternative therapies); and (f) increased medication utilization (prescription and over-the-counter). Comparisons of independent proportions (AE vs. CCATT crew members) were run on all the variables listed above for frequency analyses. Moreover, qualitative analyses were performed on textual responses to the open-ended, write-in response questions.

A number of recommendations are provided for line and medical leadership for optimizing health and improving performance of both AE and CCATT members. Such recommendations include, but are not limited to, the following: considering ways to decrease occupational stress, increase awareness of social climate issues for sustaining effective team performance, understanding and reducing barriers to behaviors that promote health, as well as embedding mental health providers within the respective units for increasing access to specialty mental health care.

2.0 INTRODUCTION

Historically, every conflict that engages the U.S. military advances the delivery of battlefield medicine [1,2]. Survivability of battlefield injuries improved dramatically in the past century, from around 80% of those injured on the battlefield surviving during World War II to current day survivability estimates of 90% and higher [3]. Although that timeframe saw many improvements in medical training, technology, and personal protective gear for the warfighter,

advancements in medical evacuation resulting in decreased transport time and the delivery of en route care significantly enhanced military medical capabilities to save lives.

The U.S. Air Force's (USAF) aeromedical evacuation (AE) system is a vital component of the military's medical evacuation mission, transporting wounded, ill, and injured military members to (and between) medical facilities throughout various parts of the globe. According to Air Force Instruction 10-2912, the mission and capabilities of the AE system require these assets to provide "expedient evacuation of patients to save life, limb, and eyesight, prevent undue suffering, and preserve military strength" [4]. These teams, traditionally consisting of two flight nurses and three medical technicians [4], provide time-sensitive en route care of up to 113 regulated (i.e., stabilized) casualties to and between medical treatment facilities (MTFs) using USAF organic and/or contracted fixed-wing aircraft with medical aircrew trained explicitly for this mission [4,5]. AE forces can operate as far forward as fixed-wing aircraft are able to conduct air operations, across the full range of military operations, and in all operating environments. AE is considered a critical capability for supporting overseas contingency operations enabling the mobility airlift system to move casualties with improved effectiveness and efficiency while rapidly delivering access to higher level medical care.

Until 1994, AE was only possible on stabilized patients [6]. However, the launch of the Critical Care Air Transport Team (CCATT) program transposed this limitation by allowing for the transport and continuing care of critically ill and injured patients who are "stabilizing" (those who have received initial resuscitation or surgical intervention but remain critically ill or injured) but are not yet medically stable [6,7]. When needed, a CCATT is called on to augment a standard AE team and is typically composed of a critical care physician, critical care nurse, and respiratory therapist with supplies and equipment necessary to provide a critical care environment that would move with the patient during evacuation [4]. The scope of CCATT care is designed to match that of an intensive care unit (ICU) in the field [8]. To ensure these capabilities, critical care involves painstaking preparation from all crew members before flight to ensure that enough resources are available to meet and manage each patient's medical needs [5].

Both AE and CCATT personnel must be technically proficient in their area of medical expertise as well as undergo extensive, supplemental training to contend with all the environmental and physiological demands that come with providing medical care on an aircraft at altitude [9]. An AE mission's success is largely dependent on its crew's preparation and flexibility, and this flexibility comes from an AE crew's ability to adapt to the demands of each individual patient. Missions can last from 1 hour to over 18 hours [8], and the duration of a mission is situation specific and depends on the nature of the patient's injuries, the location of the patient's field MTF, and the availability of airframes [10,11]. AE and CCATT crew members are required to employ careful planning, rapid assessment, and prioritization of care to deliver the best possible care with limited resources and in austere conditions. AE missions demand long work hours, constant vigilance, and the need for both physical and emotional stamina. AE crew members must possess characteristics beyond what is asked of most traditional medical personnel. AE and CCATT crew members must be clinically and operationally competent, have leadership and survival skills, exhibit personal, physical, and psychological readiness, have a high degree of group identification and integration, and be familiar with aircraft and evacuation procedures [8].

While deployed, AE and CCATT crew members live in close quarters with one another, often in austere environments [12]. At times, AE and CCATT crew members are required to carry weapons for protection [8]. Crew members are exposed to numerous flight stressors,

including gravitational forces, hypobarometric pressure, fatigue and sleep deprivation, loud noises, vibration, third-spacing dehydration, thermal stress, poor lighting, crossing multiple time zones, unpredictable schedules and irregular work hours, small workspaces with restricted movement, the threat of encountering combat activity, and separation from loved ones [8]. Due to the nature of their work, AE and CCATT crew members' inter- and intra-team dynamics differ from field MTFs and ground-based ICUs. AE and CCATT programs require a high level of cross-functionality. For example, one flight nurse must cover more patients than what is expected in "traditional" MTFs or ICUs [6,12].

Although both AE and CCATT members are exposed to similar aeronautical and operational stressors, differences do exist in the selection, training, and deployment of these medical evacuation teams. CCATT operations involve critically ill or injured patients whose management is much more likely to involve exposure to human suffering, crisis management, and even death, all while requiring the subjugation of medical personnel's concerns for their own safety and well-being to the needs of their patients. For physicians and respiratory therapists in CCATTs, the ratio of medical personnel to patients is greater than in traditional medical settings, but this is to allow these personnel to perform cross-discipline duties to assist the nurse as needed [13], which places additional demands on these medical personnel. Additionally, as a general rule, AE personnel train and deploy as a unit, often having the opportunity to work as a team and build camaraderie and cohesion prior to being exposed to the operational stresses and demands of deployment. Anecdotal discussions the authors of this study had with aeromedical leadership reveal that CCATT members are typically selected as individuals to fill a CCATT tasking; therefore, deployed CCATT members might not have ever worked or trained together prior to arriving at their deployed location. Furthermore, there are no crew rest guidance standards for deployed CCATT members. As a result, they may find themselves awake for extended duty hours (e.g., 8 to 24 hours) while working across multiple time zones, an occupational hazard that can clearly lead to fatigue and other work and health related difficulties.

In spite of these known stressors, there has been very little research that directly assesses the impact of military operations on AE personnel – either general AE or CCATT. The demands placed on AE and CCATT crew members may be impacting their long-term safety, health, and performance by overexerting their capabilities [14]. The discussions the authors of this study have had with subject matter experts from multiple units revealed significant speculation regarding the differences in pre-deployment training and that the selection methods for CCATT members may lead to greater levels of stress in CCATT members. However, a recent study of the incident rate of post-deployment mental health (PDMH) diagnoses in CCATT members revealed these personnel did not seem to be at any greater risk for receiving a mental health diagnosis following deployment than other deployed medical personnel and, in general, deployed medical personnel seem to be at similar risk for PDMH conditions as other non-medical military personnel serving in "combat-specific occupations" [15]. A follow-up examination of the potential risk factors for PDMH conditions in these CCATT personnel found that non-physician career fields (i.e., nurse and technicians), exposure to dead and/or wounded personnel, exposure to sand/dust, exposure to lasers, and use of mission-oriented protective posture overgarments were associated with increased likelihood for a PDMH condition within these critical care personnel [16]. These studies suggest that factors other than just the professional demands placed on CCATTs may be contributing to adverse health outcomes in these populations.

However, no data exist regarding impacts other than mental health diagnoses in AE and CCATT crew members. Additionally, the rate at which crew members have utilized medical

services and experienced medical conditions that they attribute to their operational duties is unknown. Additionally, there is a paucity of quantitative data measuring the frequency of health behaviors such as physical exercise, alcohol, and tobacco use in these populations. The goal of the current study is to examine these behaviors in a sample of AE and CCATT crew members. The descriptive data obtained from this study may provide substantive information to line and medical leadership that may serve to steer force management strategies for preserving the health and wellness of this critical community of aeromedical physicians, nurses, and technicians.

The goals of the study are to (a) assess self-reported behaviors (exercise frequency, alcohol and tobacco use, and changes in such behaviors) relevant to sustaining health, medical conditions perceived to be created or made worse by current assignment, and noted changes in usage of medical, mental health and alternative health services and prescription/over-the-counter (OTC) medications; and (b) identify differences in these behaviors and conditions between AE and CCATT crew members who function in deployed settings to provide critical aeromedical care to injured and ill personnel. A priori hypotheses were not directional in nature, as previous literature did not provide substantive information regarding the presence of group differences regarding such areas of functioning and healthcare utilization.

3.0 METHOD

3.1 Participants

A total of 251 AE and CCATT crew members participated in this study. Of these, 168 (66.93%) were AE crew members and 83 (33.07%) were CCATT crew members. The response rate for this study was estimated at 40% (95% confidence interval (CI) = 33.05 – 47.90) for AE and 37% (95% CI = 26.94 – 47.76) for CCATT. To calculate the response rate, the total number of crew members assigned to each unit was obtained from USAF operational leadership. The assigned numbers were then compared with the numbers of crew members who participated in the study to obtain an overall response rate.

3.2 Questionnaire

3.2.1 Demographics. The demographic questions began with a series of items that assessed rank range, age range, gender, marital status, and length of time in current duties. This section was designed such that no identifiable personal information (e.g., name or date of birth) was disclosed to maintain participant anonymity and encourage full disclosure in a community with potential strong cultural stigmas concerning mental health problems.

3.2.2 Physical Exercise Behaviors. Participants were asked the following: *how often do you engage in physical exercise/training each week (at least 20 minutes or more of aerobic, weightlifting, or resistance training per session)?* This question had the following response options: *None, 1-2, 3-4, or 5 or more times per week.*

3.2.3 Alcohol and Tobacco Use. The frequency and quantity of alcohol use and changes in alcohol and tobacco use were assessed by the following question: *how often do you have a drink containing alcohol (beer, wine, distilled spirits/liquor of all types)?* The response options were *never, monthly or less, 2-3 times a month, 2-3 times a week, and 4 or more times a week.* Next,

participants were asked the following: *how many standard drinks do you have on a typical day when you are drinking?* Response options were *1 or 2, 3 or 4, 5 or 6, 7 to 9, and 10 or more*. The next question was *has your use of alcohol changed since being assigned to your first AE squadron, or, has your use of alcohol (beer, wine, distilled spirits/liquor of all types) changed since being assigned to a CCATT UTC [unit type code]?* The response options were *not applicable (do not drink alcohol), yes, and no*. Participants were then asked the following: *if yes, how has it changed?* Response options were *do not drink alcohol anymore, alcohol use has decreased, and alcohol use has increased*. In an open-ended, write-in response question, participants were asked, *if your alcohol use changed, to what do you attribute the change?*

To assess tobacco use, participants were asked *has your use of tobacco changed since being assigned to your first AE squadron, or, has your use of tobacco changed since being assigned to a CCATT UTC?* The response options were *I do not use tobacco products, yes, and no*. The next question was as follows: *if yes, how has it changed?* Response options were *do not use tobacco anymore, tobacco use has decreased, and tobacco use has increased*. In an open-ended, write-in response, participants were asked the following: *if your tobacco use changed, to what do you attribute the change?*

3.2.4 Medical Conditions Created or Made Worse by Current Assignment. Participants were asked the following: *have you developed any new medical conditions, or have existing medical conditions worsened since being assigned to your first AE squadron, or, have you developed any new medical conditions, or have existing medical conditions worsened since being assigned to a CCATT UTC?* Response options were *yes and no*. The next question asked was as follows: *if yes, which medical conditions? Please select all that apply*. Response options were *back pain, neck pain, other joint pain (e.g., shoulder, knee), chest pain, heart palpitations, circulatory problems (e.g., DVT [deep vein thrombosis]), other heart problems, heart burn, nausea, diarrhea, constipation, unintentional weight loss/gain, sleep problems, depression, and anxiety*. Participants were also given the open-ended, write-in response option of *other (please specify)*.

3.2.5 Medical, Mental Health Support, and Alternative Healthcare Utilization. Participants were asked the following: *has your use of medical services changed (e.g., visits for healthcare, consultation with physician) since being assigned to your first AE squadron, or, has your use of medical services changed (e.g., visits for healthcare, consultation with physician) since being assigned to a CCATT UTC?* The response options for this item were *yes and no*. Next, participants were asked this question: *if yes, how has it changed?* Response options were *use of medical services has decreased and use of medical services has increased*. Participants were asked the following in an open-ended, write-in response question: *if your use of medical support services has changed, to what do you attribute the change?*

To assess mental health support, participants were asked this question: *has your use of mental health support services (e.g., chaplain, mental health counselor, Military and Family Life Consultant) changed since being assigned to your first AE squadron, or, has your use of mental health support services (e.g., chaplain, mental health counselor, Military and Family Life Consultant) changed since being assigned to a CCATT UTC?* Response options were *yes and no*. Next, respondents were asked the following: *if yes, how has it changed?* Response options were *use of support services has decreased and use of support services has increased*. In an open-ended, write-in response question, participants were asked this question: *if your use of mental health support services has changed, to what do you attribute the change?*

Alternative healthcare utilization was assessed by asking participants the following question: *has your use of alternative therapies (e.g., chiropractor, massage therapist, acupuncturist) changed since being assigned to your first AE squadron, or, has your use of alternative therapies (e.g., chiropractor, massage therapist, acupuncturist) changed since being assigned to a CCATT UTC?* Response options were *yes* and *no*. Next, participants were asked the following: *if yes, how has it changed?* The response options were *use of alternative therapies has increased* and *use of alternative therapies has decreased*. Respondents were asked the following in an open-ended, write-in response question: *to what do you attribute the change?*

3.2.6 Medication Utilization (Prescription and OTC). Participants were asked this question to assess prescription medication use: *has your use of prescription medication changed since being assigned to your first AE squadron, or, has your use of prescription medication changed since being assigned to a CCATT UTC?* The response options were *yes* and *no*. Next, participants were asked the following: *if yes, how has it changed?* Response options were *use of prescription medication has increased* and *use of prescription medication has decreased*. In an open-ended write-in response question, participants were asked the following: *to what do you attribute the change?*

OTC medication use was assessed by the following question: *has your use of over-the-counter medication changed since being assigned to your first AE squadron, or, has your use of over-the-counter medication changed since being assigned to a CCATT UTC?* The response options were *yes* and *no*. Next, participants were asked this question: *if yes, how has it changed?* Response options were *use of over the counter medication has increased* and *use of over the counter medication has decreased*. In an open-ended, write-in response question, participants were asked the following: *to what do you attribute the change?*

3.3 Procedure

Survey participation was advocated by USAF Air Mobility Command leadership and group commanders through a mass e-mail to all AE and CCATT crew members. The AE and CCATT surveys were similar, but adapted to the particular group of interest. For example, the CCATT survey asked respondents to indicate their non-deployed work unit (with the response options *ICU, emergency department, in-patient unit, out-patient unit, and other*), which is not applicable to the AE community. AE and CCATT crew members completed the occupational health screening surveys once over a specific time frame. The survey was open to all AE personnel for a 13-week period and CCATT personnel for a 9-week period in 2013.

The e-mail to potential participants stipulated that participation was voluntary and anonymous. The e-mail had a hyperlink to a Survey Monkey web-based survey containing an introductory page further explaining that participation was voluntary and anonymous, that the study was conducted by independent researchers, and that leadership would only have access to squadron-level summarized results. The script on this page explained the nature, purpose, and instructions of the study.

Following the information on the introductory page, there were directions to click the “next” button if the participant agreed to the terms of the survey and he or she wished to participate. If the participant did not click the “next” button, they opted out of survey participation. The number of personnel who chose not to participate was not obtained. In general, the survey took approximately 25 to 30 minutes to complete. After completing the survey,

participants were given information on how to obtain the summarized results of the study and when information would be available. The purpose and methodology of the study were reviewed and approved by the Air Force Research Laboratory Institutional Review Board.

3.4 Data Analysis

Data for AE and CCATT crew members were obtained via similar web-based occupational health surveys. Demographic, occupational, health behavior, healthcare utilization, and medication utilization variables that were consistent across surveys were included in the study. A variable was created in each dataset identifying the original source dataset in the merged file. Once all data cleaning was complete, the two datasets were merged.

3.4.1 Quantitative Analyses. Group frequencies and proportions were calculated for the following: (a) demographics (gender, age range, and marital status); (b) occupational variables (rank range and time in current duties); (c) health behaviors (frequency of physical exercise per week); (d) poor health habits (amount of alcohol use and elevated alcohol use, i.e., four or more times a week, three or more beverages per occasion) and increases in alcohol and tobacco use; (e) increased healthcare utilization (medical care, mental health support, and alternative therapies); and (f) increased medication utilization (prescription and OTC). The percentages for group proportions regarding self-reported increases in poor health habits, healthcare utilization, and medication utilization were based on the overall number of AE and CCATT crew members for each group, rather than the number of individuals responding to each of these questions individually.

Comparisons of independent proportions (AE vs. CCATT crew members) were run on all the variables listed above for frequency analyses. Pearson chi-square analyses or Fisher's exact tests and odds ratios were obtained via contingency table analyses on all variables listed above. Note that for all dichotomous variables, independent proportion comparisons and contingency table results are identical. Fisher's exact tests were used in place of chi-square analyses when expected cell counts in contingency tables were less than five. Odds ratios (ORs) were reported to explain the relationship between AE and CCATT crew members on each variable. For example, ORs can be interpreted as follows: the odds of AE crew members being female are 2.26 times greater than the odds of CCATT crew members being female. Odds ratios could not be computed with an observed cell count of $n = 0$ in contingency table cells for either group on any variable.

The comparison category is indicated by "a" for each variable in the tables. The comparison categories were chosen based on the following: category with the majority proportion (e.g., males, enlisted), category of interest (e.g., age range 41+ years, single, more than 1 year in current duties), and baseline category for health behavior, healthcare utilization, and medication utilization increase comparisons (e.g., engaging in physical exercise one to two times per week, no alcohol consumption per month, one to two alcoholic beverages per occasion, no increase in utilization since current assignment) to compute the odds ratios of interest to this study. For example, for age range, 41+ years old was selected as the comparison category, and separate two-by-two contingency tables were computed comparing 41+ year olds against all other age range categories. A statistical significance level of $p < .05$ was established a priori.

3.4.2 Qualitative Analyses. Two behavioral science researchers performed qualitative analyses on textual responses to the open-ended, write-in response questions. Participants' textual responses were analyzed and coded into a list of categories by each researcher independently. The list of coded categories from each researcher for each item was compared to assess inter-rater reliability. Categories that appeared to label the same or similar attributes were combined into one category. For example, responses such as *sleep issues*, *insomnia*, and *trouble sleeping* were all coded into a category titled "Sleep Problems." The frequency of coded responses for each category was computed and ranked in descending order. The top two to four coded responses are reported for open response variables.

4.0 RESULTS

4.1 Demographics

Table 1 displays demographics for overall (and by group) AE and CCATT crew members. Chi-square analyses or Fisher's exact test results and ORs for AE crew members compared to CCATT crew members are also shown in Table 1. Significantly larger proportions of AE crew members reported being female, age 26-30, single, enlisted, and having spent less than 1 year in their current duties when compared to CCATT members. While the proportion comparison was not significant, the odds of AE being age 31-35 were 2.21 times (95% CI = 1.02 – 4.81) greater than the odds of CCATT being age 31-35, when compared to age 41 or older. Significantly larger proportions of CCATT crew members reported being 36 or older when compared to AE crew members.

4.2 Physical Exercise Health Behaviors

While there were no significant differences in group proportions for each response category of weekly physical exercise, the contingency table was approaching significance at $p = .08$ (Table 2). The odds of AE exercising 3-4 times per week were 2.01 times (95% CI = 0.91 – 4.45) greater than the odds of CCATT exercising 3-4 times per week, when compared to exercising 1-2 times per week.

4.3 Poor Health Habits (Alcohol and Tobacco Use)

4.3.1 Alcohol Use. Table 3 shows significant and non-significant differences in group proportions for each response category. Significantly larger proportions of CCATT crew members reported alcohol use two or more times per week than AE crew members. Significantly larger proportions of AE crew members reported consuming three or four alcoholic beverages per occasion than CCATT crew members.

The results of qualitative analyses of participants' textual responses to the open-ended, write-in response question revealed the most frequently cited reasons for an increase in alcohol use included *social climate and squadron events promoting usage* for both AE and CCATT crew members. Additionally, *occupational and personal stress* was endorsed by AE crew members. CCATT crew members did not report any other reasons for an increase with an $n > 1$.

Table 1. Demographics Overall and by Group, Proportion Comparisons, and Contingency Table Results

Demographic	Total		AE		CCATT		<i>p</i>	Contingency Table Results for AE/CCATT			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		OR	95% CI	χ^2	<i>p</i>
Gender											
Male ^a	149	59.84	89	53.61	60	72.29	<.01			8.03	<.01
Female	100	40.16	77	46.39	23	27.71	<.01	2.26*	[1.28, 3.99]		
Age Range											
18-25	26	10.40	22	13.17	4	4.82	N/A ^b	4.49*	[1.40, 14.40]	7.08	<.01
26-30	58	23.20	48	28.74	10	12.05	<.01	3.92*	[1.71, 8.98]	11.05	<.01
31-35	52	20.80	38	22.75	14	16.87	.28	2.21*	[1.02, 4.81]	4.12	<.05
36-40	45	18.00	21	12.57	24	28.92	<.01	0.71	[0.34, 1.52]	0.77	.38
41+ ^a	69	27.60	38	22.75	31	37.35	<.05				
Marital Status											
Single ^a	99	39.44	75	44.64	24	28.92	<.05			5.75	<.05
Married	152	60.56	93	53.36	59	71.08	<.05	0.50* ^c	[0.29, 0.89]		
Rank Range											
Enlisted ^a	106	42.23	88	52.38	18	21.69	<.01			21.45	<.01
Officer	145	57.77	80	47.62	65	78.31	<.01	0.25* ^d	[0.14, 0.46]		
Time in Current Duties											
<1 year	58	23.20	49	29.34	9	10.84	<.01	3.41*	[1.58, 7.36]		
1+ years ^a	192	76.80	118	70.66	74	89.16	<.01			10.65	<.01

Note: * indicates significant Pearson chi-square test at $p < .05$. $df = 1$ for all analyses. N/A = not applicable.

^aIndicates predictor comparison category.

^bIndicates sample size assumption ($n \geq 5$) was not met.

^cInverse OR = 1.98 (95% CI [1.13, 3.48]).

^dInverse OR = 3.97 (95% CI [2.17, 7.26]).

Table 2. Physical Exercise Overall and by Group, Proportion Comparisons, and Contingency Table Results

Health Behavior	Total		AE		CCATT		<i>p</i>	Contingency Table Results for AE/CCATT			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		OR	95% CI	χ^2	<i>p</i>
Physical Exercise per Week											
None	1	0.41	1	0.61	0	0.00	N/A ^a	N/A ^b	N/A ^b	N/A ^b	N/A ^b
1-2 times ^c	30	12.20	16	9.76	14	17.07	.10				
3-4 times	155	63.01	108	65.85	47	57.32	.19	2.01	[0.91, 4.45]	3.04	.08
5 or more times	60	24.39	39	23.78	21	25.61	.75	1.63	[0.67, 3.97]	1.15	.28

Note: "None" could not be used as baseline comparison category for OR computation because CCATT $n = 0$. No analyses were significant at $p < .05$. $df = 1$ for all analyses.

^aIndicates sample size assumption ($n \geq 5$) was not met.

^bIndicates contingency table cell $n = 0$ and ORs could not be computed.

^cIndicates predictor comparison category.

Table 3. Alcohol and Tobacco Use Overall and by Group, Proportion Comparisons, and Contingency Table Results

Poor Health Habits	Total		AE		CCATT		p	Contingency Table Results for AE/CCATT			
	n	%	n	%	n	%		OR	95% CI	χ^2	p
Frequency of Alcohol Use per Month/Week											
Never ^a	33	14.10	31	18.90	2	2.86	N/A ^b				
Monthly or less	81	34.62	60	36.59	21	30.00	0.33	0.18 * ^{cd}	[0.04, 0.84]	5.75	<.05
2-4 times a month	75	32.05	52	31.71	23	32.86	0.86	0.15 * ^{ce}	[0.03, 0.66]	7.8	<.01
2-3 times a week	31	13.25	16	9.76	15	21.43	<.05	0.07 * ^{cf}	[0.01, 0.34]	14.68	<.01
4+ times a week	14	5.98	5	3.05	9	12.86	<.01	0.04 * ^{cg}	[0.01, 0.22]		<.01 ^h
Quantity of Alcohol Consumed per Occasion											
1 or 2 ^a	158	80.61	101	77.69	57	86.36	0.15				
3 or 4	33	16.84	27	20.77	6	9.09	<.05	2.54*	[0.99, 6.52]	3.95	<.01
5 or 6	4	2.04	2	1.54	2	3.03	N/A ^b	0.56	[0.08, 4.11]		.62 ^h
7 to 9	1	0.51	0	0.00	1	1.52	N/A ^b	N/A ⁱ	N/A ⁱ	N/A ⁱ	N/A ⁱ
10+	0	0.00	0	0.00	0	0.00	N/A ^b	N/A ⁱ	N/A ⁱ	N/A ⁱ	N/A ⁱ
Elevated alcohol use (4+ times per week, 3+ drinks per occasion)											
Yes	2	1.02	2	1.54	0	0.00	N/A ^b	N/A ⁱ	N/A ⁱ		
No ^a	194	98.98	128	98.46	66	100.00	N/A ^b			N/A ⁱ	N/A ⁱ
Alcohol Increase since Assignment											
Yes	31	12.35	18	10.71	13	15.66	0.26	0.65	[0.30, 1.39]		
No ^a	220	87.65	150	89.29	70	84.34	0.26			1.26	0.26
Tobacco Increase since Assignment											
Yes	9	3.59	1	0.60	8	9.64	N/A ^b	0.06 * ^{cj}	[0.01, 0.46]		
No ^a	242	96.41	167	99.40	75	90.36	N/A ^b				<.01 ^h

Note: * indicates significant Pearson chi-square or Fisher's exact test at $p < .05$. $df = 1$ for all analyses.

^aIndicates predictor comparison category.

^bIndicates sample size assumption ($n \geq 5$) was not met.

^cIndicates confidence intervals are wide and should be interpreted with caution.

^dInverse OR = 5.43 (95% CI [1.19, 24.65]).

^eInverse OR = 6.86 (95% CI [1.51, 31.09]).

^fInverse OR = 14.53 (95% CI [2.95, 71.54]).

^gInverse OR = 27.90 (95% CI [4.61, 168.77]).

^hIndicates Fisher's exact test results.

ⁱIndicates contingency table cell $n = 0$ and ORs could not be computed.

^jInverse OR = 17.81 (95% CI [2.19, 144.98]).

4.3.2 Tobacco Use. Table 3 shows non-significant differences in group proportions reporting an increase in tobacco use since their current assignment.

The results of qualitative analyses of participants' textual responses to the open-ended, write-in response question revealed the most frequently cited reasons for an increase in tobacco use included *occupational and personal stress* for AE and CCATT crew members. No other reasons for an increase were reported by AE or CCATT crew members with an $n > 1$.

4.4 Medical Conditions

A total of 47 out of 159 (29.56%) AE crew members and 28 out of 79 (35.44%) CCATT crew members reported new or worsened medical conditions since their current assignment. There was no significant difference in proportions of AE and CCATT crew members reporting new or worsened medical conditions since their current assignment ($p = .36$). The most commonly reported medical conditions were the same for both groups (see Table 4). There were no significant differences in proportions of AE and CCATT members reporting *musculoskeletal injury/pain*, *sleep problems*, or *emotional distress*.

Table 4. Most Frequently Cited Conditions Perceived to be Created or Worsened by Current Assignment and Proportion Comparisons

Medical Condition	AE ^a		CCATT ^b		<i>p</i>
	<i>n</i>	%	<i>n</i>	%	
Musculoskeletal injury/pain (e.g., back, neck, joint pain)	53	31.55	27	32.53	.88
Sleep problems (e.g., insufficient sleep)	15	8.93	13	15.66	.11
Emotional distress (e.g., anxiety, depression)	12	7.14	10	12.05	.20

Note: There were 112 responses from AE crew members and 76 responses from CCATT crew members.

^aDenominator *n* = 168.

^bDenominator *n* = 83.

4.5 Healthcare Utilization

4.5.1 Medical Services. Table 5 shows non-significant differences in group proportions reporting an increase in medical care since their current assignment.

The result of qualitative analyses of participants' textual responses to the open-ended, write-in response question revealed the most frequently cited reasons for an increase in medical care utilization included *musculoskeletal injury/pain*, *medical conditions/general sickness* (tie), and *flying status requirements* (tie) for AE crew members and *medical conditions/general sickness*, *musculoskeletal injury/pain*, and *sleep issues* for CCATT crew members.

4.5.2 Mental Health Support Services. Table 5 shows non-significant differences in group proportions reporting an increase in mental health support services utilization since their current assignment.

The results of qualitative analyses of participants' textual responses to the open-ended, write-in response question revealed the most frequently cited reasons for an increase in mental health care included *occupational stress* (e.g., long hours, shift work, relational conflict with co-worker/supervisor) and *marital/family problems* (e.g., partner-relational difficulties, geographical separation from family, workload duties affecting family relationship) for both AE and CCATT crew members. Additionally, AE crew members frequently cited *emotional distress* (e.g., depression) as a reason for an increase in mental health support utilization. CCATT crew members did not report any other reasons for an increase with an *n* > 1.

Table 5. Healthcare Utilization Overall and by Group, Proportion Comparisons, and Contingency Table Results

Healthcare Service	Total		AE		CCATT		<i>p</i>	Contingency Table Results for AE/CCATT			
	n	%	n	%	n	%		OR	95% CI	χ^2	<i>p</i>
Medical Care Increase since Assignment								0.72	[0.35, 1.46]	0.83	.36
Yes	38	15.14	23	13.69	15	18.07	.36				
No ^a	213	84.86	145	86.31	68	81.93	.36				
Mental Health Support Increase since Assignment								0.59	[0.28, 1.26]	1.89	.17
Yes	32	12.75	18	10.71	14	16.87	.17				
No ^a	219	87.25	150	89.29	69	83.13	.17				
Alternative Therapy Increase since Assignment								0.65	[0.31, 1.33]	1.40	.24
Yes	36	14.34	21	12.50	15	18.07	.24				
No ^a	215	85.66	147	87.50	68	81.93	.24				

Note. No analyses significant at $p < .05$. $df = 1$ for all analyses. OR = odds ratio. CI = confidence interval. ^a indicates predictor comparison category.

4.5.3 Alternative Health Services. Table 5 shows non-significant differences in group proportions reporting an increase in alternative healthcare utilization since their current assignment.

The results of qualitative analyses of participants' textual responses to the open-ended, write-in response item revealed the most frequently cited reasons for an increase in alternative healthcare utilization included *musculoskeletal injury/pain* (e.g., seeking chiropractic care, acupuncture, massage therapy for back, neck pain) and *occupational stress* (e.g., seeking massage therapy to reduce muscle tension from work) for both AE and CCATT crew members.

4.6 Medication Utilization

4.6.1 Prescription Medication. Table 6 shows significant differences in group proportions reporting an increase in prescription medication usage since their current assignment. Significantly larger proportions of CCATT crew members reported an increase in prescription medication usage since their current assignment than AE crew members.

The results of qualitative analyses of participants' textual responses to the open-ended question revealed the most frequently cited reasons for an increase in prescription medication usage included *musculoskeletal injury/pain*, *hypertension*, *other medical conditions/general sickness*, and *sleep issues* (e.g., insufficient sleep) for AE crew members and *sleep issues*, *musculoskeletal injury/pain* (tie), *medical conditions/general sickness* (tie), and *emotional distress* (tie) for CCATT crew members.

Table 6. Medication Utilization Overall and by Group, Proportion Comparisons, and Contingency Table Results

Medication	Total		AE		CCATT		<i>p</i>	Contingency Table Results for AE/CCAT			
	n	%	n	%	n	%		OR	95% CI	χ^2	<i>p</i>
Prescription Increase since Assignment								0.46* ^a	[0.23, 0.91]	5.11	<.05
Yes	39	15.54	20	11.90	19	22.89	<.05				
No ^b	212	84.46	148	88.10	64	77.11	<.05				
OTC Increase since Assignment								0.35* ^c	[0.17, 0.75]	7.92	<.01
Yes	33	13.15	15	8.93	18	21.69	<.01				
No ^b	218	86.85	153	91.07	65	78.31	<.01				

Note: * indicates significant Pearson chi-square test at $p < .05$. $df = 1$ for all analyses.

^aInverse OR = 2.20 (95% CI [1.10, 4.39]).

^bIndicates predictor comparison category.

^cInverse OR = 2.82 (95% CI [1.34, 5.94]).

4.6.2 OTC Medication. Table 6 shows significant differences in group proportions reporting an increase in OTC medication usage since their current assignment. Significantly larger proportions of CCATT crew members reported an increase in OTC medication usage since their current assignment than AE crew members.

The results of qualitative analyses of participants' textual responses to the open-ended question revealed the most frequently cited reasons for an increase in OTC medication usage included *musculoskeletal injury/pain* and *occupational stress* (e.g., high levels of stress and discomfort associated with long work demands and poor ergonomics) for both AE and CCATT crew members. Additionally, CCATT crew members frequently cited *sleep issues* (e.g., insufficient sleep) as a reason for increased OTC medication utilization. AE crew members did not report any other reasons for an increase with an $n > 1$.

5.0 DISCUSSION

Although it is clear that AE and CCATT members are exposed to considerable flight stressors, challenging work environments, and other occupational stressors including human trauma and suffering, unpredictable work schedules and concerns for personal safety and well-being, little is known about the health impact of deployed operations on these crew members. The goal of this study was to gather quantitative and qualitative data regarding medical symptoms and health behaviors in a sample of AE and CCATT members.

Demographic analyses revealed some notable differences in this sample of AE and CCATT crews. AE crews members tended to be younger, unmarried, enlisted females with less time in their current duties (1 year or less) as compared to CCATT crew members who were more likely to be married and older (36+ years old). As a result of these demographic differences, the CCATT members in this sample would be expected to have more experience in their fields and might be expected to have more consistent, stable personal lives that could serve as protective factors in the face of significant stress. However, alternatively, the younger, unmarried AE members may be less likely to have family or personal obligations to balance with a rigorous occupational life. Subsequent differences in health behaviors need to be interpreted in light of these significant socio-demographic differences. It is also important to note that it is

unknown if the demographic differences are typical of the AE versus CCATT populations in general or if they represent sample selection bias to the self-report survey methodology of this study.

5.1 Current Health Behaviors

The current Physical Activity Guidelines for Americans recommends at least 150 minutes a week of moderate-intensity or 75 minutes a week of vigorous-intensity aerobic physical activity for maximum health benefits [17]. Although the survey in this study did not allow for respondents to specify the intensity of their exercise, if it is assumed that most people exercise at a moderate intensity, only those respondents who indicated the highest frequency (*5 or more times*) would even approach the U.S. Department of Health and Human Services recommendations for maximum health benefits (25.6% of CCATT and 23.8% of AE).

According to the latest Gallup poll, 51.6% of Americans report exercising for 30 or more minutes 3 days or more per week [18]. Although the structure of the current survey does not allow for a direct comparison to the Gallup data, 89.6% of AE and 82.9% of CCATT crew members report exercising 60 minutes or more per week, suggesting these groups are exercising similarly to the American adult population. Regular physical activity has benefits for long-term health, as it decreases the risk of developing conditions such as cardiovascular disease, diabetes, and obesity [19]. Physical exercise has also been shown to be beneficial for reducing stress [20]. Overall, however, according to the U.S. Department of Health and Human Services, the respondents to this survey are not getting enough exercise to achieve maximal health benefits.

Overall, a different pattern of alcohol consumption emerged between the AE and CCATT respondents, with CCATT respondents drinking less, more frequently and with AE respondents drinking more, less frequently. Given the demographic differences between the two groups (specifically, age, gender, and education differences), these patterns may be an artifact of demographic rather than occupational differences; therefore, attributions for these differences must be made with caution. National surveys on alcohol use indicate that being male and having higher levels of education are associated with drinking more frequently and being male is associated with drinking large quantities in a single sitting [21]. A larger proportion of AE respondents endorsed being between 18-25 years old, which suggests that a larger proportion of AE respondents were likely not of drinking age. Although this cannot be assumed to mean that they do not consume alcohol, it is likely safe to assume that military members who are underage are very unlikely to endorse drinking on a Government-sponsored survey. Therefore, the proportion of underage respondents from the AE units could explain the much larger percentage of AE respondents who endorsed abstaining (18.9% vs. 2.86%, respectively).

When compared to the latest Gallup data on drinking behaviors of the American adult population (aged 18-54) [22], the AE/CCATT respondents to the survey do not seem to engage in problem drinking at the same rate as their counterparts in the general population. According to the National Institutes of Alcohol Abuse and Alcoholism, 7.1% of adults 18+ endorsed heavy drinking (5+ drinks in 5 days or more) in the past month in 2012 and 24.6% of adults reported binge drinking (4 or more drinks in a sitting for women and 5 or more drinks in a sitting for men) in the past month. Although the nature of the questions in this survey do not allow for direct comparisons to these data, the proportion of respondents who endorsed drinking 5 or more drinks was 2% overall in this sample. This suggests that in this sample of healthcare providers and technicians, problem alcohol consumption is rare.

However, this sample did report abstaining from alcohol use at a considerably lower rate than the American adult population (28% of American adults report abstaining vs. 18.9% of AE and 2.86% of CCATT respondents) [22]. Both AE and CCATT respondents indicated *social climate and squadron events promoting usage* as the primary driving force behind increased alcohol consumption since arriving for their current assignment. These data taken together could suggest that the social climate in these units may be encouraging drinking behavior, albeit at “social” or non-problematic levels. This is an area that warrants additional investigation to determine the exact patterns of alcohol consumption in these potentially high-stress, high operations tempo populations.

While specific data regarding the frequency, quantity, and type of tobacco products used were not gathered in this survey, the data that were collected reveal a potential difference between AE and CCATT members regarding their motivations for using and increasing their use of tobacco products. A relatively small proportion of this sample (n = 9; 3.6%) endorsed an increase in tobacco use since their current duty assignment. However, eight of those respondents were CCATT members, and these CCATT members attributed the increase to “*occupational and personal stress*,” suggesting they may be engaging in health-demoting behaviors to manage occupational stress and demands. Although this is a relatively small proportion of respondents who endorsed an increase in tobacco use, in light of the fact that smoking rates in American adults are 9.1% for those with a college degree and 5.9% for those with a postgraduate degree or higher [23], this 3.6% increase could be a notable change in this highly educated population and should be investigated further to better understand tobacco use and change in CCATT crew members.

Approximately 3 of every 10 AE crew members and 7 of every 20 CCATT members reported new or worsened medical conditions since their current assignment. While there were no significant differences between the two groups in the proportions of respondents who identified medical conditions created or made worse by their current assignment, both groups most frequently identified musculoskeletal pain or injury, sleep problems, and emotional problems. These results may speak to the unique stressors, both physical and psychological, experienced by these mobile medical teams.

Between 12% and 15% of the total sample endorsed an increase in each of the three types of healthcare utilization (medical, mental health, and alternative health). While there were no significant differences between groups with respect to any type of healthcare utilization, both groups endorsed seeking medical care for their musculoskeletal problems and general sickness or medical conditions; CCATT members endorsed seeking medical care for their sleep problems as one of their top attributions, while AE members did not. Since both AE and CCATT respondents endorsed sleep issues being created or made worse by their current duties, this difference in healthcare utilization may suggest that the sleep disruption associated with being a CCATT member causes greater impairment than sleep schedules associated with AE team responsibilities. Both groups endorsed increases in utilization of alternative healthcare (e.g., chiropractic care, acupuncture, or massage therapy) for musculoskeletal injury or pain and occupational stress, and both groups cited occupational stressors and marital or family problems as reasons for their increased mental health care. However, AE crew members also endorsed emotional distress, such as depression, leading to their increase in seeking mental health care. These results suggest that AE crew members are seeking assistance from mental health professionals in response to emotional distress.

Finally, with respect to medication utilization, a larger proportion of CCATT crew members endorsed both an increase in prescription medication (22.9%) and OTC medication use (21.7%) as compared to AE crew members (11.9% and 8.9%, respectively). Analyses of qualitative responses revealed that the most frequently cited reasons for increasing prescription medication use for both groups were musculoskeletal injury/pain and general sickness/medical conditions. AE respondents also endorsed sleep issues and hypertension while CCATT respondents endorsed emotional distress. For OTC medication increases, both groups endorsed musculoskeletal pain/injury and occupational stress, but CCATT respondents also endorsed sleep issues. With more than one in five CCATT respondents endorsing a change in medication usage as a result of their current assignment, this issue definitely warrants additional investigation. It is unclear if this finding is an artifact of the older age of CCATT respondents or if it is an indication of occupational exposure or even the social climate of the units. For example, CCATT members did not identify emotional distress as a reason for increasing mental health care utilization, but they did attribute emotional distress with their increasing medication usage. This could be an indication that CCATT respondents are more likely to take medication to manage their emotional stress than to seek mental health care. Notably, although both groups seem to be experiencing sleep problems, CCATT members may be less likely to seek medication from their medical providers for this problem and to turn to OTC medications. It is unclear if this represents a difference in the intensity of the sleep issues between AE and CCATT members or a reluctance to seek professional health services/medication on the part of the older, more educated CCATT members.

5.2 Recommendations for Line Leadership

Several suggestions for medical leadership are noted below. These changes might improve environmental conditions in these mobile medical units to optimize performance and improve health. Improving health behaviors will likely reduce substance use behaviors, improve physical health, and lead to decreased medical/mental healthcare utilization and medication use.

Both groups endorsed increased occupational and/or personal stressors as causes of increased alcohol and tobacco use. Line leadership may consider ways to decrease occupational stress to help mitigate substance use as a coping mechanism, as research has demonstrated decreased occupational stress is associated with a decreased need for self-medication through substance use [24,25]. Leadership also should be very aware of any social climate issues that would encourage the use of alcohol.

Physical activity has been shown to reduce perceptions of stress [20] and may be particularly relevant to military members working in difficult operational settings with high levels of psychological stress. AE and CCATT team members both endorsed engaging in physical exercise as sub-optimal frequencies. Better understanding the barriers to physical exercise (time, access to facilities limited by shiftwork, etc.) and taking steps to increase access for these medical professionals will likely result in psychological and physical health benefits.

5.3 Recommendations for Medical Leadership

The results of this survey also identify specific areas medical and mental health leadership can target for prevention and intervention as a means to mitigate some of the health impacts reported by AE and CCATT team members.

It is also recommended that, where feasible, medical leadership embed dedicated mental health providers within these units. It is also recommended that experienced mental health providers who are selected for this position are trained on the nature of AE and CCATT operations and the inherent stressors and challenges associated with such duties. This will give mental health providers the context and background required for understanding the unique stressors and adjustments faced by crew members as well as the routine rigors of daily operations. Such training is necessary for mental health providers to fully understand the rigors of AE and CCATT crew duties and to make discretionary judgments about a team member's capability to adequately perform his or her duties when there are negative changes to his or her psychological health.

Medical and mental health providers assigned to AE and CCATT units should also engage in group-specific outreach efforts that target alcohol and stimulant use (caffeinated beverages), sleep hygiene, occupational stress, and physical exercise routines and habits tailored to overcoming health problems associated with mobile duties in which members are standing, lifting, and engaging in other physical demands.

5.4 Limitations of the Study

Although this study raises awareness of potentially problematic health behaviors that may benefit from interventions, there are some limitations to consider. First, the intent of this study is not to diagnose, but only to screen for indicators of negative health outcomes. Second, this study is also not able to account for preexisting conditions (prior to being assigned to aeromedical operations) that may have affected self-report and study outcomes. Third, this study did not match the questionnaire pattern to pull information that would allow for direct comparisons with national averages. The non-standardized items provide only a general glimpse into specific areas of health. Subsequent administrations of the survey could benefit modifications to non-standardized items that allow for more direct comparisons. Fourth, the nature of this study was not amenable for cause-effect conclusions to be drawn. Although analyses of textual responses provide reasons for increased alcohol, tobacco, medical/mental health care, and medication usage (prescription and OTC), additional studies are needed for making definitive conclusions. Fifth, the results of this study did not fully address the functional impairment of the health behaviors reported, such as substance use (i.e., alcohol, prescription drugs). Furthermore, participants reporting sleep issues, increased use of medical services, medical symptoms, and increases in substance use do not necessarily require treatment or intervention. The study can be improved upon via simultaneous assessment of functional impairment to support the validity of assumptions to performance that are made. Sixth, self-report surveys are prone to response bias from a self-selected sample that might affect generalization of results. Simply put, whenever assessing for the impact within an organization, it is always a possibility there will be sampling bias. This bias may occur as a result of those individuals who are at highest risk and wanting to expose their concerns. However, sampling bias is not necessarily a negative issue if it serves to reveal the intended, at-risk population. In spite of these limitations, the current findings support the notion that working in the operationally demanding AE and CCATT environment may be associated with adverse health outcome that would benefit from being addressed by line and medical leadership.

5.5 Areas of Future Study

Better understanding the specific stressors and operational demands of AE and CCATT members as well as the overall socio-demographic milieu from which these personnel come will aid in the identification of specific risk and protective factors for negative health behaviors and outcomes. Additionally, future research should assess severity of functional impairment from the symptoms that were endorsed by these survey respondents (e.g., emotional distress and sleep issues) to determine the need for and the type of appropriate interventions. A more in-depth examination of actual combined stimulant use (i.e., caffeine, energy supplements, nicotine products) should be done to assess the cumulative effects on sleep quality, recovery, and performance optimization within this and similar operational communities.

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LIST OF ABBREVIATIONS AND ACRONYMS

AE	aeromedical evacuation
CCATT	Critical Care Air Transport Team
CI	confidence interval
ICU	intensive care unit
MTF	medical treatment facility
OR	odds ratio
OTC	over-the-counter
PDMH	post-deployment mental health
USAF	U.S. Air Force
UTC	unit type code